9270F-10501
~~LA-26589~~

MP MASTER
MA29863

SCIENTIFIC-ATLANTA, INC.
3845 PIEDMONT ROAD, N.E. ATLANTA 5, GEORGIA — TEL. TRINITY 5-3020 — FAX DIV. TWX AT

INSTRUCTION MANUAL
OSCILLATOR UNIT
MODEL RFO 15.5
SERIAL NO. _____

First Edition
August 1961

NOTE

WHEN CONNECTED TO A POWER SUPPLY, LETHAL HIGH VOLTAGES MAY BE PRESENT IN THIS UNIT AND MORE THAN ORDINARY CAUTION SHOULD BE EXERCISED WHEN WORKING CLOSE TO THE BWO TUBE WIRING.

MODEL RFO 15.5

OSCILLATOR UNIT

CONTENTS

		Page No.
1.	GENERAL DESCRIPTION	
	1.1 Introduction	1-1
	1.2 Specifications	1-1
2.	DETAILED DESCRIPTION	2-1
	2.1 Circuit Description	2-1
	2.2 Operating Precautions	2-2
3.	INSTALLATION	3-1
	3.1 General	3-1
	3.2 Use With WE 2 Weatherproof Enclosure	3-1
	3.3 Rack Mounting	3-2
4.	PARTS LIST	4-1

SECTION 1
GENERAL DESCRIPTION

1.1 Introduction

The Model RFO 15.5 Oscillator Unit is one of a series of interchangeable backward-wave oscillator units which mount in the Model RFH 1 Oscillator Unit Housing. When used with the Model RT2D Remote Tuning Unit and the Power Supply, it constitutes a remotely tunable signal source covering the frequency range from 15.5 to 24 kMc.

The Model RFO 15.5 consists of a CSF CO 2012A BWO (Backward-wave Oscillator) tube, a tube mounting adaptor plate, and associated wiring and connectors. The necessary blower for cooling is included in the Model WE 2 enclosure. When used with the Model WE 2 enclosure, the complete assembly is suitable for mounting at the terminals of a transmitting antenna. The Model RFH 1 Oscillator Unit Housing and the Model WE 2 Weatherproof Enclosure are described in another manual.

1.2 Specifications

Frequency Range	15.5 to 24 kMc
Power Output	5 to 125 mw
Output Connector	UG-425/U
Power Source	Scientific-Atlanta, Inc., Model MPS 21 or Equivalent
Dimensions	
Height	9-1/2 inches
Width	17 inches
Depth	6-1/2 inches
Weight (approximately)	18 pounds

SECTION 2
DETAILED DESCRIPTION

2.1 Circuit Description

Figure 2.1 gives the power requirements of a typical backward-wave oscillator tube. All operating potentials are supplied by the Model PS 21 Power Supply. The oscillator tunes electronically as the voltage between its delay line and cathode is varied from 2600 volts to a minimum value of approximately 650 volts. The delay line, connected internally to the metal shell of the tube, is grounded while the cathode operates at a variable negative potential. The anode is maintained at a fixed positive potential, typically 270 volts, with respect to the cathode. A fixed bias between 0 and -250 volts is applied to the control grid. Figure 2.2 shows typical tuning and power output characteristics of the oscillator unit as functions of delay line potential.

A tuning chart supplied with the oscillator unit indicates the average tuning characteristics of the CO 2012A as a function of the setting of the TUNING potentiometer on the Model RT 2D Remote Tuning Unit. From this chart, the operating frequency may be determined to within approximately 5%. Experience obtained since the CO 2012A has been placed in production indicates that resettability to within ± 0.1 % or ± 5 mc, whichever is greater, can be expected; therefore, for more precise frequency settings, a calibration chart may be prepared for the individual tube in service.

A circuit diagram of the Model RFO 15.5 is shown in Figure 4.1. Electrode potentials for the BWO tube are applied through connector 1-J1. The corresponding cable mates with connector 1-J5 of the Model PS 21 Power Supply. Test points 1-TP1 and 1-TP2 are provided for heater voltage measurement.

2.2 Operating Precautions

Do not operate the tube at delay line voltages greater or less than the values indicated on the manufacturer's individual tube data sheet. This data sheet is included with each Model RFO. Do not operate the tube at delay line currents greater than 40 milliamperes.

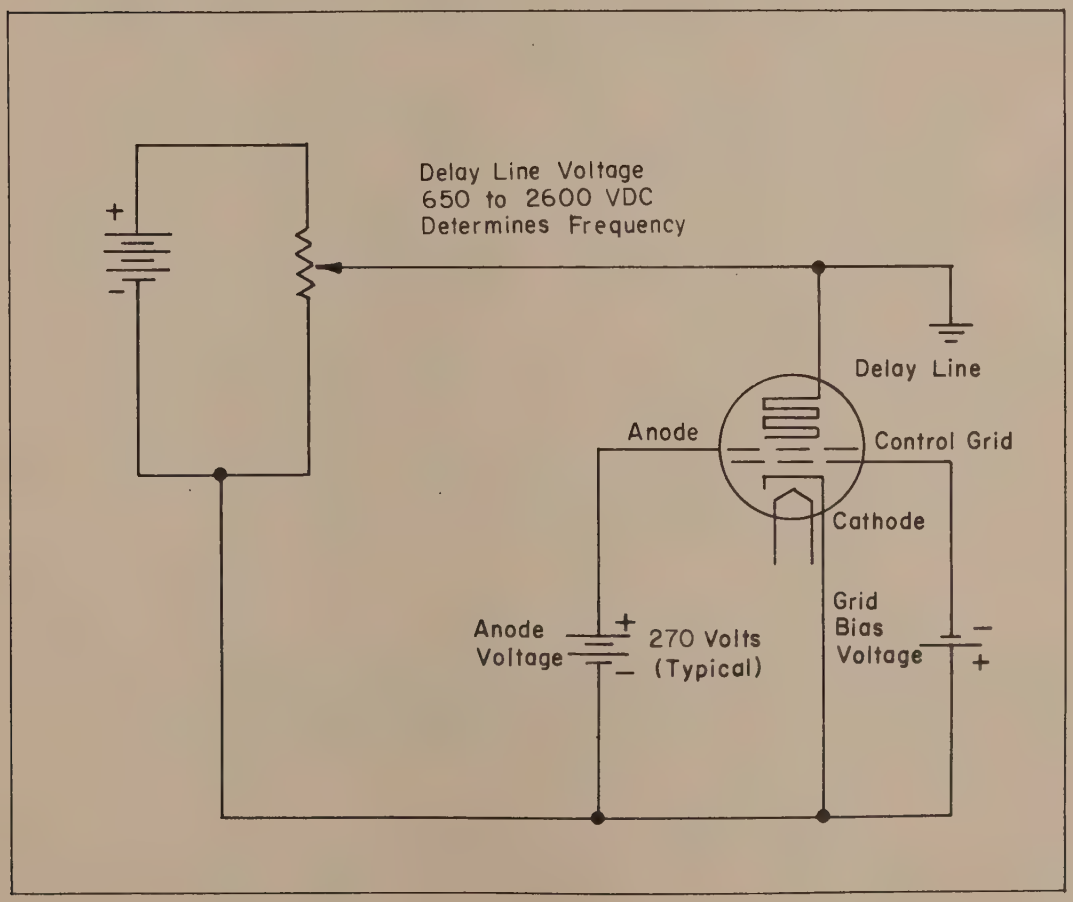


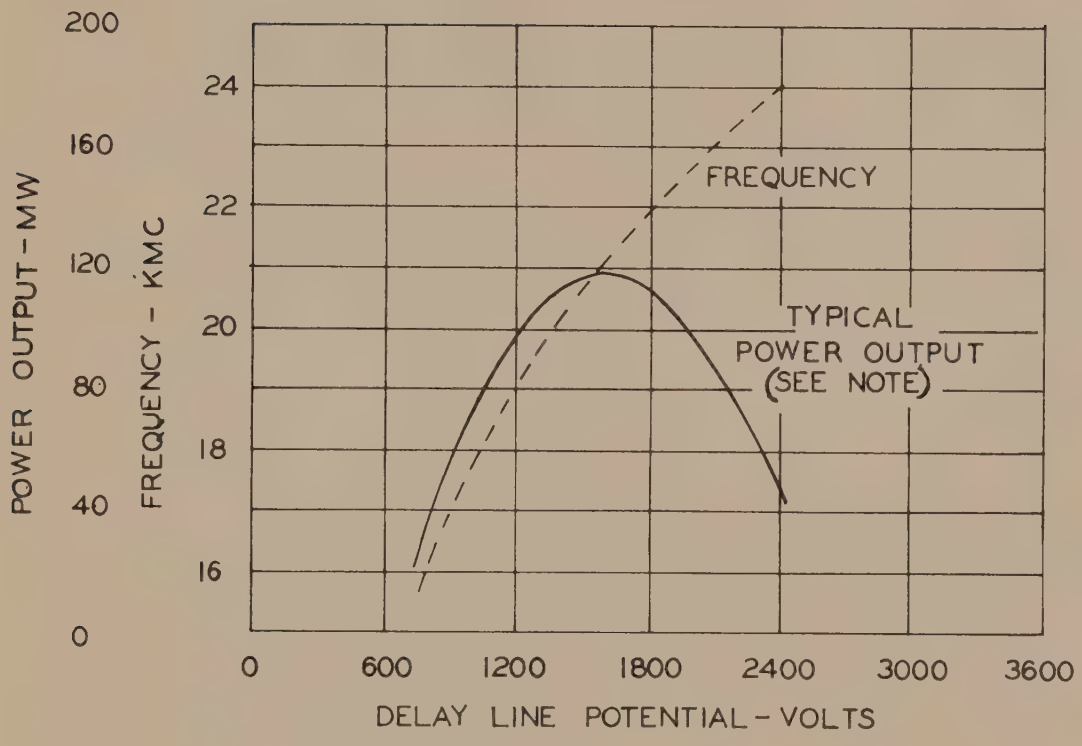
Figure 2.1 Simplified Schematic.

CSF CO 2012A

BACKWARD-WAVE OSCILLATOR

15.5 - 24 kmc

5 - 125 mw



Note: The fine grain structure of the power curve shows multiple minima and maxima points as the frequency is varied. In no case will the points of minimum power output be below the specified minimum power level.

Figure 2.2 Typical Power Output and Frequency Versus Delay Line Potential.

SECTION 3
INSTALLATION

3.1 General

Proper operating anode and grid voltages for the particular BWO tube are given on the manufacturer's data sheet. Power supply adjustment procedures are given in the Model PS 21 BWO Power Supply instruction manual.

The oscillator unit should be installed, according to paragraph 3.2, in a Model RFH 1 housing, which supports and cools the RFO unit.

The common "ground" for all circuits of the PS 21 is connected to the BWO tube mounting plate. Consequently, the RFO unit mounting plate must be grounded to ground the entire system. If the oscillator unit is not firmly secured to a grounded metal structure, a separate ground wire should be connected to the oscillator unit.

The manufacturer's recommendations (see manufacturer's data sheet) concerning handling and the tube's proximity to ferromagnetic objects and external fields should be carefully observed. Failure to comply can hamper the tube's operation or result in its ultimate failure.

3.2 Use With WE 2 Weatherproof Enclosure

The procedure for mounting the Model RFH 1 housing in the Model WE 2 enclosure is given in the Model RFH 1-WE 2 instruction manual. To install the oscillator unit in the housing-enclosure combination, hold the mounting plate with the chrome handles down. Next, insert the mounting plate into the upper set of nylon slides in the housing and secure the plate with the two upper cam locks. Then insert the ~~calbes~~ cables through the bottom of the enclosure.

138

3.3 Rack Mounting

The Model RFH 1 housing must be prepared for rack mounting according to instructions in its separate instruction manual.

After the Model RFH 1 is prepared for rack mounting, the oscillator unit is installed by orienting the mounting plate with the chrome handles in front, and inserting it into the lower set of nylon slides. Then secure the mounting plate with the two sets of cam locks.

142

SECTION 4
PARTS LIST

MODEL RFO 15.5
OSCILLATOR UNIT
MANUFACTURERS' CODE LETTERS

Code	Manufacturer
ATR	Airtron, Inc., Division of Litton Industries
BIR	Birnbach Radio Company, Inc.
CSF	Compagnie Générale de Télégraphic Sans Fil
J	Johnson Company, E. F.
O	Ohmite Manufacturing Company
SA	Scientific-Atlanta, Inc.
SH	Smith, Inc., Herman H.
WI	Winchester Electronics, Inc.

PARTS LIST

MODEL RFO 15.5

OSCILLATOR UNIT

Component Designation	Description	Mfr.*	Mfr. Part No.
1-J1	Connector: high voltage, 6 contact	WI	PM6PHV-3102A20
1-J2	Connector: banana plug; mounted on ceramic post.	BIR	452 J
1-P3	Connector: banana jack	J	108 - 301
1-R1	Resistor: fixed, composition, 9.1K, 5 %, 1/2 watt	O	"Little Devil"
1-TP1	Test Jack: red	SH	240
1-TP2	Test Jack: blue	SH	240
1-V1	Tube: backward-wave oscillator, 15.5 to 24 kMc	CSF	CO2012A
1-W1	Waveguide: Flexible, 6 inches long	ATR	BN209-0600
1-W2	Adapter: Waveguide flange, UG-595/U to UG-425/U	SA	RFO15.5-MA-5083

*See "TABLE OF MANUFACTURERS' CODE LETTERS"

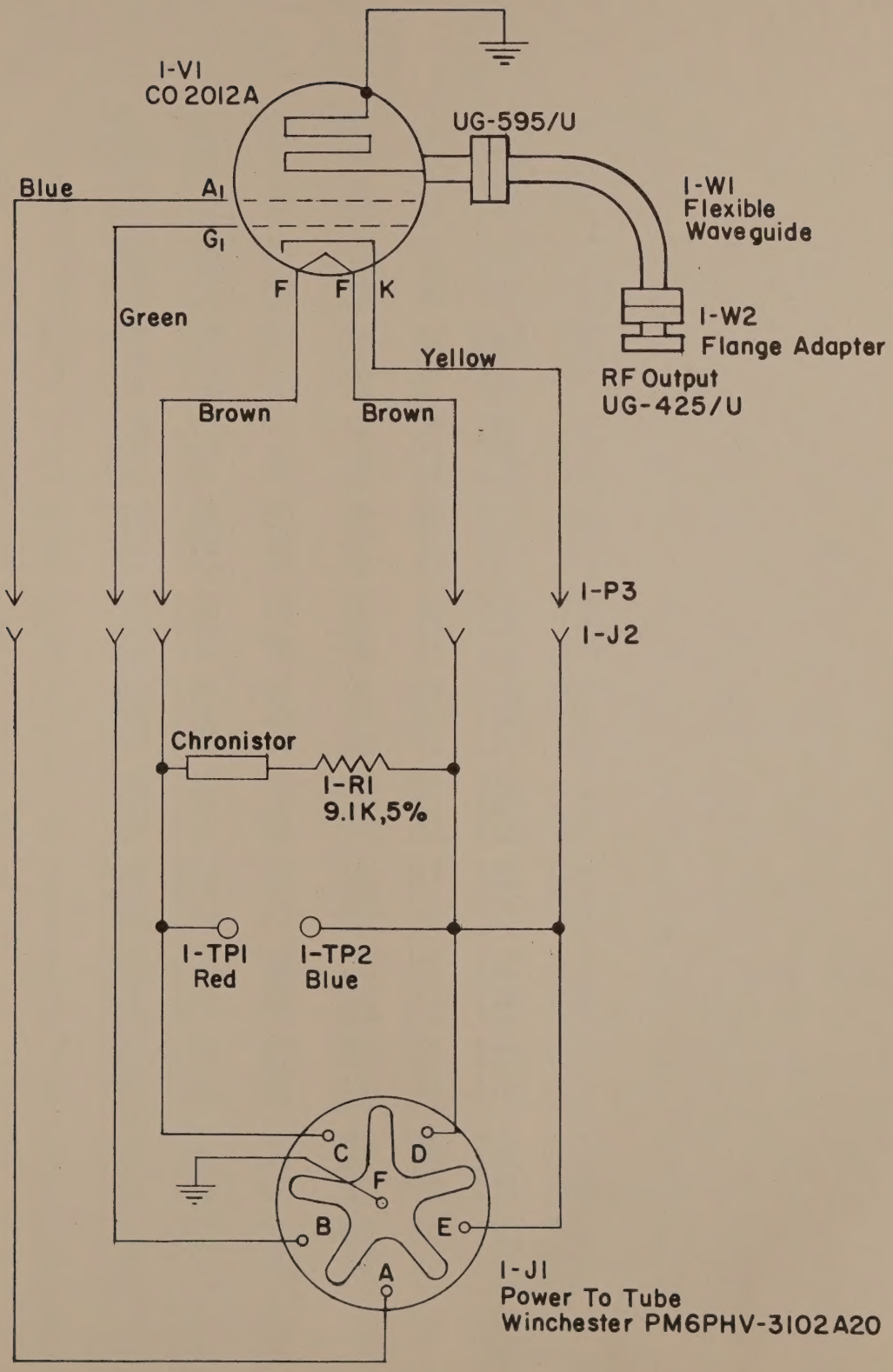


Figure 4.1. Model RFO 15.5 Oscillator Unit Schematic Diagram.

CONVERSION OF VOLTAGE AND POWER RATIOS TO DECIBELS

The basic chart below indicates the number of decibels (db) corresponding to the listed ratios of voltage or power over the range of −20 to +20 db. For voltage or power ratios greater than those included in the chart, the ratio can be broken down into a product of two numbers, the value in db for each found separately, and the two results added. Example: To convert a power ratio of 2,000:1 to db, express 2,000 as 2×10^3; the number of db corresponding to a power ratio of 2 is very nearly 3, and the number of db for a power ratio of 10^3 is 30. Therefore, the power ratio of 2,000:1 is approximately 30 db + 3 db = 33 db. In the lower right-hand corner of the chart db values for voltage and power ratios of integral powers of 10 are given.

Voltage Ratio	*Power Ratio*	*−db+*	*Voltage Ratio*	*Power Ratio*	*Voltage Ratio*	*Power Ratio*	*−db+*	*Voltage Ratio*	*Power Ratio*	*Voltage Ratio*	*Power Ratio*	*−db+*	*Voltage Ratio*	*Power Ratio*
1.000	**1.000**	**0**	**1.000**	**1.000**	**.447**	**.200**	**7.0**	**2.239**	**5.012**	**.200**	**.0398**	**14.0**	**5.012**	**25.12**
.989	.977	.1	1.012	1.023	.442	.195	7.1	2.265	5.129	.197	.0389	14.1	5.070	25.70
.977	.955	.2	1.023	1.047	.437	.191	7.2	2.291	5.248	.195	.0380	14.2	5.129	26.30
.966	.933	.3	1.035	1.072	.432	.186	7.3	2.317	5.370	.193	.0372	14.3	5.188	26.92
.955	.912	.4	1.047	1.096	.427	.182	7.4	2.344	5.495	.191	.0363	14.4	5.248	27.54
.944	.891	.5	1.059	1.122	.422	.178	7.5	2.371	5.623	.188	.0355	14.5	5.309	28.18
.933	.871	.6	1.072	1.148	.417	.174	7.6	2.399	5.754	.186	.0347	14.6	5.370	28.84
.923	.851	.7	1.084	1.175	.412	.170	7.7	2.427	5.888	.184	.0339	14.7	5.433	29.51
.912	.832	.8	1.096	1.202	.407	.166	7.8	2.455	6.026	.182	.0331	14.8	5.495	30.20
.902	.813	.9	1.109	1.230	.403	.162	7.9	2.483	6.166	.180	.0324	14.9	5.559	30.90
.891	**.794**	**1.0**	**1.122**	**1.259**	**.398**	**.159**	**8.0**	**2.512**	**6.310**	**.178**	**.0316**	**15.0**	**5.623**	**31.62**
.881	.776	1.1	1.135	1.288	.394	.155	8.1	2.541	6.457	.176	.0309	15.1	5.689	32.36
.871	.759	1.2	1.148	1.318	.389	.151	8.2	2.570	6.607	.174	.0302	15.2	5.754	33.11
.861	.741	1.3	1.161	1.349	.385	.148	8.3	2.600	6.761	.172	.0295	15.3	5.821	33.88
.851	.724	1.4	1.175	1.380	.380	.145	8.4	2.630	6.918	.170	.0288	15.4	5.888	34.67
.841	.708	1.5	1.189	1.413	.376	.141	8.5	2.661	7.079	.168	.0282	15.5	5.957	35.48
.832	.692	1.6	1.202	1.445	.372	.138	8.6	2.692	7.244	.166	.0275	15.6	6.026	36.31
.822	.676	1.7	1.216	1.479	.367	.135	8.7	2.723	7.413	.164	.0269	15.7	6.095	37.15
.813	.661	1.8	1.230	1.514	.363	.132	8.8	2.754	7.586	.162	.0263	15.8	6.166	38.02
.804	.646	1.9	1.245	1.549	.359	.129	8.9	2.786	7.762	.160	.0257	15.9	6.237	38.90
.794	**.631**	**2.0**	**1.259**	**1.585**	**.355**	**.126**	**9.0**	**2.818**	**7.943**	**.159**	**.0251**	**16.0**	**6.310**	**39.81**
.785	.617	2.1	1.274	1.622	.351	.123	9.1	2.851	8.128	.157	.0246	16.1	6.383	40.74
.776	.603	2.2	1.288	1.660	.347	.120	9.2	2.884	8.318	.155	.0240	16.2	6.457	41.69
.767	.589	2.3	1.303	1.698	.343	.118	9.3	2.917	8.511	.153	.0234	16.3	6.531	42.66
.759	.575	2.4	1.318	1.738	.339	.115	9.4	2.951	8.710	.151	.0229	16.4	6.607	43.65
.750	.562	2.5	1.334	1.778	.335	.112	9.5	2.985	8.913	.150	.0224	16.5	6.683	44.67
.741	.550	2.6	1.349	1.820	.331	.110	9.6	3.020	9.120	.148	.0219	16.6	6.761	45.71
.733	.537	2.7	1.365	1.862	.327	.107	9.7	3.055	9.333	.146	.0214	16.7	6.839	46.77
.724	.525	2.8	1.380	1.905	.324	.105	9.8	3.090	9.550	.145	.0209	16.8	6.918	47.86
.716	.513	2.9	1.396	1.950	.320	.102	9.9	3.126	9.772	.143	.0204	16.9	6.998	48.98
.708	**.501**	**3.0**	**1.413**	**1.995**	**.316**	**.100**	**10.0**	**3.162**	**10.000**	**.141**	**.0200**	**17.0**	**7.079**	**50.12**
.700	.490	3.1	1.429	2.042	.313	.0977	10.1	3.199	10.23	.140	.0195	17.1	7.161	51.29
.692	.479	3.2	1.445	2.089	.309	.0955	10.2	3.236	10.47	.138	.0191	17.2	7.244	52.48
.684	.468	3.3	1.462	2.138	.306	.0933	10.3	3.273	10.72	.137	.0186	17.3	7.328	53.70
.676	.457	3.4	1.479	2.188	.302	.0912	10.4	3.311	10.96	.135	.0182	17.4	7.413	54.95
.668	.447	3.5	1.496	2.239	.299	.0891	10.5	3.350	11.22	.133	.0178	17.5	7.499	56.23
.661	.437	3.6	1.514	2.291	.295	.0871	10.6	3.388	11.48	.132	.0174	17.6	7.586	57.54
.653	.427	3.7	1.531	2.344	.292	.0851	10.7	3.428	11.75	.130	.0170	17.7	7.674	58.88
.646	.417	3.8	1.549	2.399	.288	.0832	10.8	3.467	12.02	.129	.0166	17.8	7.762	60.26
.638	.407	3.9	1.567	2.455	.285	.0813	10.9	3.508	12.30	.127	.0162	17.9	7.852	61.66
.631	**.398**	**4.0**	**1.585**	**2.512**	**.282**	**.0794**	**11.0**	**3.548**	**12.59**	**.126**	**.0159**	**18.0**	**7.943**	**63.10**
.624	.389	4.1	1.603	2.570	.279	.0776	11.1	3.589	12.88	.125	.0155	18.1	8.035	64.57
.617	.380	4.2	1.622	2.630	.275	.0759	11.2	3.631	13.18	.123	.0151	18.2	8.128	66.07
.610	.372	4.3	1.641	2.692	.272	.0741	11.3	3.673	13.49	.122	.0148	18.3	8.222	67.61
.603	.363	4.4	1.660	2.754	.269	.0724	11.4	3.715	13.80	.120	.0145	18.4	8.318	69.18
.596	.355	4.5	1.679	2.818	.266	.0708	11.5	3.758	14.13	.119	.0141	18.5	8.414	70.79
.589	.347	4.6	1.698	2.884	.263	.0692	11.6	3.802	14.45	.118	.0138	18.6	8.511	72.44
.582	.339	4.7	1.718	2.951	.260	.0676	11.7	3.846	14.79	.116	.0135	18.7	8.610	74.13
.575	.331	4.8	1.738	3.020	.257	.0661	11.8	3.890	15.14	.115	.0132	18.8	8.710	75.86
.569	.324	4.9	1.758	3.090	.254	.0646	11.9	3.936	15.49	.114	.0129	18.9	8.811	77.62
.562	**.316**	**5.0**	**1.778**	**3.162**	**.251**	**.0631**	**12.0**	**3.981**	**15.85**	**.112**	**.0126**	**19.0**	**8.913**	**79.43**
.556	.309	5.1	1.799	3.236	.248	.0617	12.1	4.027	16.22	.111	.0123	19.1	9.016	81.28
.550	.302	5.2	1.820	3.311	.246	.0603	12.2	4.074	16.60	.110	.0120	19.2	9.120	83.18
.543	.295	5.3	1.841	3.388	.243	.0589	12.3	4.121	16.98	.108	.0118	19.3	9.226	85.11
.537	.288	5.4	1.862	3.467	.240	.0575	12.4	4.169	17.38	.107	.0115	19.4	9.333	87.10
.531	.282	5.5	1.884	3.548	.237	.0562	12.5	4.217	17.78	.106	.0112	19.5	9.441	89.13
.525	.275	5.6	1.905	3.631	.234	.0550	12.6	4.266	18.20	.105	.0110	19.6	9.550	91.20
.519	.269	5.7	1.928	3.715	.232	.0537	12.7	4.315	18.62	.104	.0107	19.7	9.661	93.33
.513	.263	5.8	1.950	3.802	.229	.0525	12.8	4.365	19.05	.102	.0105	19.8	9.772	95.50
.507	.257	5.9	1.972	3.890	.227	.0513	12.9	4.416	19.50	.101	.0102	19.9	9.886	97.72
.501	**.251**	**6.0**	**1.995**	**3.981**	**.224**	**.0501**	**13.0**	**4.467**	**19.95**	**.100**	**.0100**	**20.0**	**10.000**	**100.00**
.496	.246	6.1	2.018	4.074	.221	.0490	13.1	4.519	20.42					
.490	.240	6.2	2.042	4.169	.219	.0479	13.2	4.571	20.89	10^{-2}	10^{-3}	30	10^{2}	10^{3}
.484	.234	6.3	2.065	4.266	.216	.0468	13.3	4.624	21.38		10^{-4}	40		10^{4}
.479	.229	6.4	2.089	4.365	.214	.0457	13.4	4.677	21.88		10^{-5}	50		10^{5}
.473	.224	6.5	2.113	4.467	.211	.0447	13.5	4.732	22.39	10^{-3}	10^{-6}	60	10^{3}	10^{6}
.468	.219	6.6	2.138	4.571	.209	.0437	13.6	4.786	22.91		10^{-7}	70		10^{7}
.462	.214	6.7	2.163	4.677	.207	.0427	13.7	4.842	23.44	10^{-4}	10^{-8}	80	10^{4}	10^{8}
.457	.209	6.8	2.188	4.786	.204	.0417	13.8	4.898	23.99		10^{-9}	90		10^{9}
.452	.204	6.9	2.213	4.898	.202	.0407	13.9	4.955	24.55	10^{-5}	10^{-10}	100	10^{5}	10^{10}
											10^{-11}	110		10^{11}
										10^{-6}	10^{-12}	120	10^{6}	10^{12}

SCIENTIFIC-ATLANTA, INC.

2162 PIEDMONT RD., N. E. • ATLANTA 9, GA.

MP MASTER
MA29863